

Reflective Project Summary for “Implement Engineering!” grant 2020-21
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Ours was a team project, with 5 high school Engineering and Science teachers involved. Our students participated in a 4-5 day immersion experience around the global challenge of providing clean water to people around the world by engaging with local and global engineers and scientists who work towards meeting that challenge.

There were six components to the experience:

- 1) History of waterborne diseases, water access, treatment, storage, and distribution presented in a Zoom session by an Ohio EPA scientist-engineer who is also on Young Professionals committee of American Water Works Association (AWWA) (presentation to students, and Q&A). 4 key points of presentation were: Water is the most important natural resource we have, over the past few hundred years, drinking water safety and regulation have come a long way, a career in drinking water is for the creative and curious who want to serve the public, and AWWA is an organization in which all are invited to participate.
- 2) Local water-related processes, from the perspective of our City of Dayton Water Department presented in a Zoom session by lab and field scientists (presentation to students, demonstrations, and Q&A)
- 3) Overview of the SNDdeN African Photovoltaic Clean Water Project (presented by me supplemented with a 7-minute video previously professionally created about the Project)
- 4) African Photovoltaic Clean Water Project presented in a very interactive Zoom session by the two project engineer managers
- 5) P&G Pur packet demonstration in the classroom by me
- 6) Hands-on student activity: Design, construct, and test a water filtration system

The project engaged 101 students across grade levels 9-12. Our project was implemented in five Engineering classes, across two semesters, from September - April. Student immersion experiences were conducted within one week, but planning, scheduling, and coordination among teachers and guest presenters, and purchasing of activity materials, extended beyond those single weeks.

The project met the desired outcomes. In a short time period, and an authentic challenge-based context, we were able to expose students to the APP and several local and regional professionals working in the drinking water industry, and their organizations and employers. The guest presenters, who were of various ages, genders, ethnicity, and educational backgrounds, shared firsthand their expertise and career awareness information with the students. It was one of just a few times our school and our STEMM program engaged so many students (15% of our total student body) from our four Engineering courses in a single learning experience and project within one year. Such implementations prove especially impactful as students (and teachers) talk among their peers who are not in an Engineering course, and hearing about the project piques their interest.

Only one of the five teachers (Matt) involved in the project had any prior knowledge of the APP. As a team, the five teachers and I refined our ability to plan and coordinate logistics for effective practical collaboration among teachers, with curricula content and professionals external to our school community. Although an in-person visit to the APP Learning Lab in Cincinnati was not possible for the teachers, nor any of the students, we have plans to schedule such a visit for those teachers and our school administrators, during this summer.

We cultivated new relationships with professionals from the City of Dayton Water Department and Ohio EPA, which will continue into the future, for the benefit of our students. We anticipate being introduced to Cincinnati area Engineers Without Borders professionals, with the help of the Learning Lab manager,

when we visit the Lab, or in fall 2021.

The four teachers other than Matt ended up team teaching their four classes in pairs, due to one short-term paternity leave and the recognition, during fall semester, that a team approach provided benefits to the students, since those teachers had minimal prior high school teaching experience. Our administration decided to continue that team teaching approach in the future, which, I believe, will benefit the students and allow them to learn from multiple engineering disciplines.

Students, in general, responded well. Most of the juniors and seniors involved had some preliminary knowledge about the APP and the P&G purifier packet process, but had not ever considered water access, treatment, and distribution processes from a system perspective, and in a facilitated educational setting (nor likely even in an informal personal setting). Freshmen and sophomores, for the most part, did not have prior knowledge.

They were likely not ever encouraged to consider the many process steps involved before we so easily and plentifully access water in our homes. The students were astounded to learn the realities of water-related challenges in developing countries, and by the comparison of their systems vs. those in our region. Hands-on activities, such as the filtration devices, always excite students, and allowed them to collaborate and develop teamwork skills.

We plan to make this project an annual one for our Engineering classes, and have ideas to integrate work across the classes. We will expand the project to our Biomedical Science courses and other Science courses. We will work with the global APP manager to explore the desire and relevance of the gravity-fed spring box system activity and other elements of the global project to which our students can contribute. At the Learning Lab, the manager hopes to have installation of the water filtration and treatment system complete in the fall 2021, which will provide additional authentic work and data for the student project. In the future non-COVID times, we will invite guest presenters in person, and take students on a field trip to the Learning Lab in Cincinnati. An additional field trip to a local water treatment plant and testing lab will also be added. We will provide a modified and condensed version of the project for our 24 middle grade STEMM campers this summer during the week of June 28.

Actual Purchases:

\$ 60.18	expendable supplies and materials for the water filtration devices (IED, CEA, POE)
\$ 12.98	expendable supplies and materials for water filtration devices (IED, EDD)
\$149.95	20 pairs of lab safety goggles (to be stored and used in the Learning Lab)
\$ 37.88	desktop world globe for use in the Learning Lab and at outreach events
\$ 0	River Stewards Coordinator donated two copies of the Into the River book
\$153.34	Vernier Turbidity Tester and glass sample bottles

\$414.33

\$385.67 remaining funds:

\$ 75	expendable supplies and materials for summer camp week of June 28
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Remainder will go towards fall 2021 engineering class supplies to repeat the project, or towards furnishings and durables for the Learning Lab in Cincinnati (e.g. a 55-gal barrel for water storage, a locking storage cabinet, and a white board).